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Rapid grain size coarsening between Upper and Middle Siwaliks Units: sign of an increase in the sediment flux from the Himalayas or simple sediment motion process?

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The Siwaliks in the Himalayan foreland form a continuous belt from Pakistan to Eastern India. This small and narrow range that hardly reaches 1000m in elevation and 20km wide is associated to the most active thrust across the Himalayas, the Main Frontal Thrust. The exhumation of the old Miocene-Pleistocene foreland basin has been extremely quick since the late Pleistocene, while the present foreland basin is migrating southward.

Fluvial Siwaliks Series (4000 to 6000 in total thickness) are divided in 3 homogeneous units: **Upper Siwaliks** are mainly unconsolidated conglomerates (Pliocene and Pleistocene, with a median grain size or "D50" around 1 to 2cm), **Middle Siwaliks** are dominated by unconsolidated sandstones called "Salt and Pepper" (Pliocene, with a D50 below 0.1mm), and **Lower Siwaliks** are made up of consolidated sandstones with carbonaceous cement. Usually **the transition between Siwaliks Conglomerates and Salt and Pepper Sandstones is very rapid**, and had been often interpreted as the sign of **a change in tectonic activity or climate in the Himalayas during the Pliocene**. We have tested this hypothesis comparing present river alluviums and Pliocene sediments.

In the three small watershed chosen for the study (Churre Khola, Bakeya Khola, Ratu Khola, in Central Nepal), the evolution of the grain size has been measured both in old deposits and in recent alluviums. Grain size is measured by sieve analysis and by photo analysis. (1) The cross sections in Siwaliks Series show that there is actually a rapid coarsening up section from Middle to Upper Siwaliks Units: gravels appear

within a few tens of meters. (2) Such a rapid transition is also observed in present rivers channels: the passage from gravel covered channel reaches (upstream) to sand covered channel reaches (downstream) occurs only in a few kilometres and is generally located 10 or 15 km downstream from the outlet of the Siwaliks Range in the Gangetic Plain.

We strongly suspect that the drastic increase in grain size observed in Siwaliks Series results from the same hydrological process described along present rivers in the Gangetic foreland basin. This hydrological process has been described in other fluvial systems everywhere in the world and is often related to a break in slope or an excess in sand supply [Sambrook and Ferguson, 1995; Wilcock, 1998; Gasparini and al., 2003]. The sudden appearance of gravels in the Upper Siwaliks would thus correspond to the crossing of this sorting transition during southward facies migration, in association with the activity of Himalayan frontal thrusts. **It does not require any change in tectonic or climatic forcing**.